ARPA-E's 37 Projects Selected From Funding Opportunity Announcement #1

Project Title:	Wave Disc Engine
Organization:	Michigan State University
Funding Amount:	$2,540,631
Website:	www.msu.edu

Brief Description of Project

The Wave Disk Generator revolutionizes auto efficiency at lower vehicle costs. Currently, 15% of automobile fuel is used for propulsion; the other 85% is wasted. A Wave Disk Generator hybrid uses 60% of fuel for vehicle propulsion.

MSU's shock wave combustion generator is the size of a cooking pot and generates electricity very efficiently. This revolutionary generator replaces today's 1,000 pounds of engine, transmission, cooling system, emissions, and fluids resulting in a lighter, more fuel-efficient electric vehicle. This technology provides 500-mile-plus driving range, is 30% lighter, and 30% less expensive than current, new plug-in hybrid vehicles. It overcomes the cost, weight, and driving range challenges of battery-powered electric vehicles.

This development exceeds national CO_2 emission reduction goals for transportation. A 90% reduction is calculated in CO_2 emissions versus gasoline engine vehicles. Wave Disk Generator application scales as small as motor scooters and as large as delivery trucks, due to its small size, low weight, and low cost. This technology enables us to radically improve the atmosphere and human health of major global cities.

Why ARPA-E Funding and Not Private Capital

- This is cutting-edge research with a research risk that private capital won't accept.
- Mathematically difficult transient combustion technology is well situated for university researchers.
- Requires developing new low-cost, high rpm generators, which currently do not exist in automotive markets.
- Breakthrough automotive research is difficult to fund without committed large customers.

Uniqueness/Benefits of Technology

The Wave Disk Generator replaces the automotive internal combustion engine, radiator/water pump, fuel/air control, transmission, and generator found in today's hybrid vehicles, resulting in a "hyper-efficient" serial hybrid vehicle that provides a 3.5 times improvement in fuel consumption efficiency.

Wave Disk Generator Consumer Benefits:

- Full-size vehicles with 500-mile driving range
- Compressed natural gas, hydrogen, gas or renewable fuels
- Elimination foreign oil dependence
- 30% lower vehicle costs
- 90% less CO_2 emissions

For inquiries, contact

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Addressable Market & Potential Customers

Wave Disk Generator light-vehicle platforms offer 30% lower prices plus refueling costs that are one-third those of traditional hybrids. Based on an OEM cost of $500 per vehicle, Wave Disk Generator provides cost and efficiency leadership to a $25 billion annual power component market supplying 50 million new automobiles and light trucks annually. Continued oil and gasoline price increases could motivate rapid consumer vehicle replacements over the next 15 years.

Key Team Member Bios

Dr. Norbert Müller, associate professor, mechanical engineering and principal investigator with over 15 years of expertise in the invention, development, design construction, and testing of innovative turbo machinery.

Dr. Tonghun Lee, assistant professor, mechanical engineering, with research expertise in laser spectroscopic imaging of advanced propulsion and energy conversion systems.

Dr. Indrek Wichman, professor, mechanical engineering, has 30 years' experience in combustion modeling and experimentation including vehicle fire safety.

Dr. Patrick Kwon, associate professor, mechanical engineering, with expertise in advanced materials design and manufacturing; manufacturing processes; mechanical behavior of materials.

Dr. Elias G. Strangas, associate professor, electrical engineering, with hybrid vehicle power train experience; works on the analysis and design of high-efficient electrical machines, drives, and power electronics.

Dr. Fang Peng, professor, electrical engineering, with expertise in hybrid transportation power electronics, controls, and motor drives.

Roger Koenig, adjunct professor, with over 30 years experience in research management, technology start-up creation, fund raising, and M&A, including 10 years as a public tech company CEO & chairman.

Miscellaneous

Wave Disk Generator hybrid platform research needs to be accelerated and collaborated to quickly transition to commercialization. This new platform can uniquely provide hyper-efficient vehicles with superior customer cost, safety, and utility. U.S. automotive technology leadership can be re-established globally. A near-term solution is offered to energy dilemmas of diminishing oil supplies and 80% reductions needed in global CO2 emissions.

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Testimonials

"What makes the Wave Disk Generator a compelling idea is that it -- like all good research -- builds on the shoulders of decades of work in this area, and then adds that serendipitous insight of a new, more promising approach. Only now, thanks to advanced computer technology, can we take this innovation to a new level of efficiency and potential."
J. Ian Gray, Vice President for Research and Graduate Studies
Michigan State University

"This project builds on Michigan State University's expertise in both automotive and alternative energy technologies, and represents the kind of innovation that we have always invested in: good ideas that can be made extraordinary through the creativity, hard work, and perseverance of our scientists and engineers."
Lou Anna K. Simon, President
Michigan State University

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